DEPARTMENT OF MARINE RESOURCES

MAINE STATE AQUARIUM FIELD TRIP GUIDE

McKown Point Road
West Boothbay Harbor, Maine

A Message to Educators

The staff of the Maine Department of Marine Resources Education Division looks forward to welcoming you and your students to our public aquarium. We invite your class to learn about the ocean and the richness of life that it supports through our collection of regional fish and invertebrates on display.

The aquarium building was constructed in 1993 along with the new research facility. The floor plan and exhibits were designed by the staff of the Education Division and the support systems for the aquarium were built by the staff of the Maintenance and Operations Division. The new Marine Resources Aquarium opened to the public on June 10, 1995. In 2006, we changed our name to the Maine State Aquarium to better identify who and what we are.

The goal of the Education Division is to develop a citizenry that has an awareness and an appreciation of the marine environment and its resources. In order to accomplish this goal, school children, educators and visitors to the aquarium are provided with current information pertaining to Maine's marine resources.

We hope that you and your students will gain an understanding of the State of Maine's connection to the sea through your visit to the Marine Resources Aquarium.

Sincerely yours,

The Staff

Planning Your Field Trip to the Marine Resources Aquarium

A field trip to the Maine Department of Marine Resources Aquarium is an exciting addition to your curriculum. This information, and the ***Chaperone Sheet*** that follows, will assist you in planning your trip.

Reservations

Reservations for each calendar year start on January 1 of that year. Please make your reservation electronically on our web site at www.maine.gov/dmr. If you are unable to do this, call 207-633-9542.

Due to limited space, reservations are on a first-come, first-serve basis.

Admission

- Admission is free to all State of Maine approved public and private school groups.
- Admission is free to all home schools that are approved by the Maine Department of Education.

Pre-Trip Plans

- Incorporate this ***Field Trip Guide*** into your curriculum so that your class focuses on Maine's marine life before and after your visit. The enclosed information and activities will help your students get the most out of their Aquarium experience.
- One adult chaperone is recommended for every five students. Organize your small groups prior to your arrival. Please have each student wear a nametag.
- The ***Chaperone Sheet*** that follows this page should be copied for each chaperone. They should carry this sheet with them during your visit. The ***Chaperone Sheet*** contains Aquarium rules and educational tips to help successfully lead students through the Marine State Aquarium. Please send the ***Chaperone Sheet*** out in advance of the trip, so chaperones can familiarize themselves with the information.
- Before your Aquarium visit, explain to your chaperones what you would like the students to learn from the field trip. Assure them that they will not need to know the answers to all the students' questions. They are there as guides to encourage students to ask questions.
- You may want to copy the ***Aquarium Activities*** sheets for your students to work on while they are at the Aquarium.

Directions to the Aquarium

Take Route 1 to Route 27 South that leads to Boothbay Harbor. Continue on Route 27 South towards Southport. Take a left 6/10 of a mile past St. Andrews Hospital. Follow the

McKown Point Road to the very end. You will pass by the Coast Guard Station and Bigelow Laboratory before reaching the Maine State Aquarium.

Arrival at the Aquarium

- Limited bus parking is available in front of, or along the road to the Aquarium.
- A public rest room and phone are available. A water fountain is located near the rest rooms. The Aquarium does not have a snack bar.
- Picnic tables are available on a first-come, first-serve basis.

Chaperone Sheet

Dear Chaperone,

Your role as a chaperone is crucial while your group visits the Maine State Aquarium. You will have the opportunity to help us make your group's visit a fun, memorable and educationally rewarding experience.

The information on this sheet will help you guide students through the Aquarium. As a chaperone, you will be responsible for ensuring that Aquarium rules are followed. The best way to do this is to keep the students actively engaged in learning, and to make sure that they know the rules before the trip.

Rules:

1. No running is allowed in the building or on the Aquarium porch.
2. No banging on the glass. The sound and vibration of tapping disturbs all of the animals.
3. No climbing on exhibits.
4. Do not remove animals from the touch tank area.
5. Do not grab the tails of the sharks or skates. Gently touch these fish.
6. Throw all trash in the garbage cans.
7. Stay with your chaperone at all times. Do not wander from the group.

Your role as a chaperone:

Children will be fascinated by the animals in the Aquarium. They will become most interested in the touch tank and the shark tank spending only a few seconds at the other tanks. The best service that you can provide is to focus their attention on the tanks located in the rock wall and get them to look, think, and ask questions. You do not need to know the answer to all of their questions but say "I don't know - how could we find out?" (Further observation? Other students? Graphic panels? Aquarium Guide? or Research?)

At any tank you can ask the students to:

- Identify the animals by using the species labels near each tank.
- Observe the animals in the tanks. Find the ways that they are adapted to feeding, moving, holding on, protecting themselves, and to their environment. Find an animal that is camouflaged.
- "Adopt" one animal and watch it for three minutes. How did it behave? How much time would it take scientists to observe an animal and become an expert on every aspect of its behavior?
- How many animals are in this tank? Answer quickly, then spend a full minute looking and counting.

At the aquaculture tanks (mussels, oysters, and salmon), you can ask the students:

- What is aquaculture? Why are we farming the ocean?

At the shark tank, the students can get up close and personal with the sharks and skates but do not allow them to grab these fish by their tail.

- What are these small sharks called? Locate a spine in front of each dorsal fin.
- Gently rub the shark's skin from back to front. What does it feel like?
- If a skate is swimming at the surface, gently flip it over to discover its underside features.
- A skate's egg case is often called a mermaid's purse. Hold one up to the light to see if there is a developing young within. It takes a whole year before the baby skate hatches out.

At the touch tank, the students may pick up and release the animals gently. Support them with 2 hands.

Discover Mollusks (Clams, mussels, snails, scallops and oysters all have hard shells and soft bodies.)

- Moon Snail: What is the gooey, muscular part? (Touch its foot until it pulls it completely into its shell.)
- Scallop: What are all of the blue dots on the edge of the scallop? Why does it clap its shells and squirt water?

Discover Arthropods (Horseshoe crabs, lobsters, crabs, and barnacles all have jointed legs.)

- Horseshoe Crab: Does it use its tail as a weapon? (Place it down on its back and observe its tail action.) Locate its eyes, mouth, and book gills.
- Lobster: Hold it near the surface of the water in case it attempts to escape. How does it move? How old might this baby lobster be? What does it use its claws (pincher and crusher) for?
- Crab: Identify the green crab, rock crab, hermit crab, and toad crab. (Be careful, they all have claws!) Which one is living in a snail's shell? Which one looks like a spider?

Discover Echinoderms (Sea stars, sea urchins, sea cucumbers, and sand dollars are spiny skinned.)

- Sea Star: How many suction cup tube feet does it have? Find the mouth in the center and an eyespot at the tip of each arm.
- Sea Urchin: How many teeth are found in its mouth? What might it like to eat?
- Sea Cucumber: Find its 5 rows of tube feet. It might squirt water on its own, do not squeeze it.

1

Pre-trip Activities

GENERATIONS OF FISHING

Fishing is one of the oldest and most popular outdoor activities. The earliest evidence of primitive man showed that they were fishermen. Probably using their bare hands and clubs, early man first used fish as food. Throughout the years, new techniques were invented. Early man made spears out of bone, antler, horn or stone. Often they would build a dam on a stream with rocks. The dam made a pool where the fish would gather, helping the fishermen catch fish.

Hooks have been used for fishing for thousands of years. The hooks were made of animal bones, shells, gourds, bronze, antlers, and horns. The shape of hooks used by primitive fishermen are very similar to those used today.

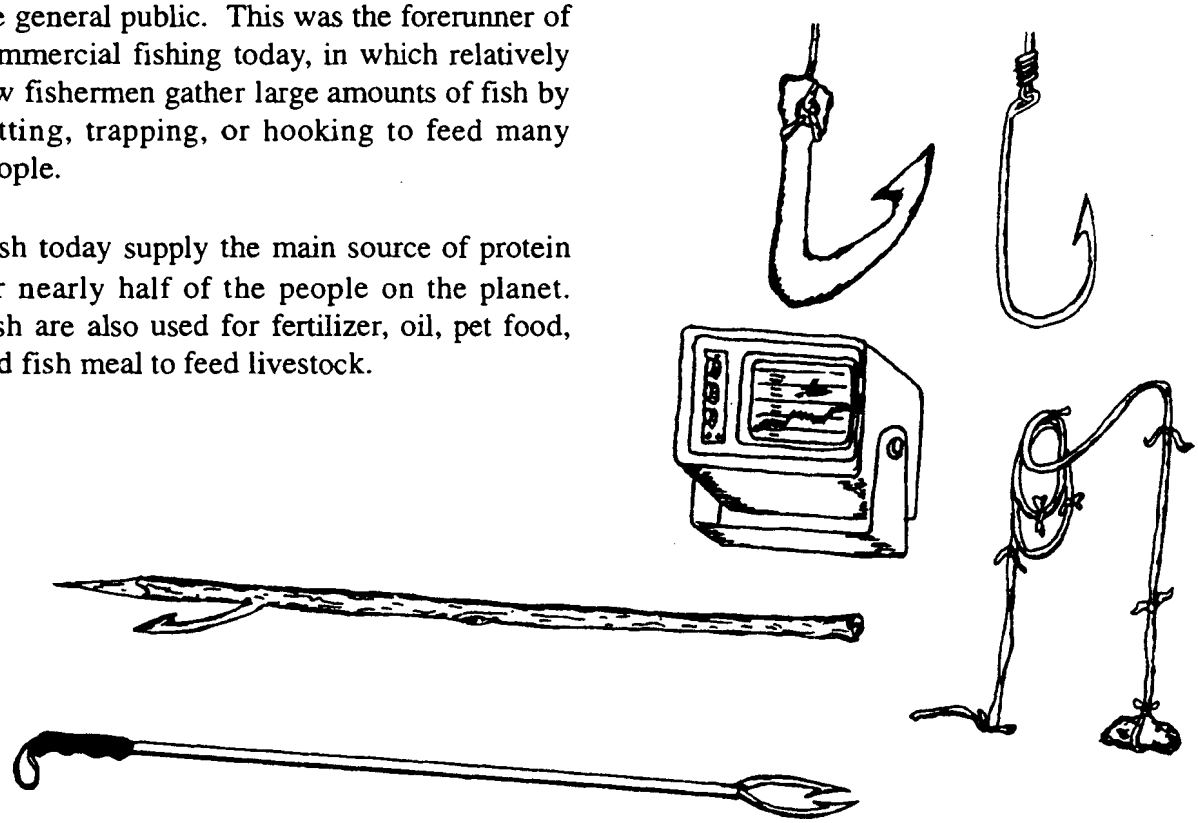
Following the use of spears and hooks to gather fish, the net was invented. It was the net that enabled fishing to move from feeding the family and tribe, to the business of feeding the general public. This was the forerunner of commercial fishing today, in which relatively few fishermen gather large amounts of fish by netting, trapping, or hooking to feed many people.

Fish today supply the main source of protein for nearly half of the people on the planet. Fish are also used for fertilizer, oil, pet food, and fish meal to feed livestock.

Over 60 million people fish today for enjoyment. They are called sport fishermen. The catch is often eaten by the angler's family and friends. Sport fishermen do not sell their catch. Many sport fishermen release their fish unharmed as soon as the fish are caught.

Sport fishing means different things to different people. For some, fishing gives them an opportunity to get away from the hustle and bustle of daily routine and enjoy the nation's rich natural resources. Some people see fishing as an exciting and demanding sport. Other anglers combine fishing with boating, picnicking, camping, and backpacking.

Fishing is something that everybody can do. Try fishing with your family or a group of friends. Remember, boys, girls, moms, dads, grandparents, cousins, and friends can all enjoy fishing.



THE HISTORY OF FISHING IN MAINE

Early 1600s: Fishermen from Europe come to the Maine coast each year, establishing seasonal fishing camps on the islands to clean, salt, and dry their catches.

1614: Capt. John Smith sails to Monhegan and explores the Maine coast. According to history books he says that the fish "can afford as good gold as the mines of Guiana with less hazard and more certainty and felicity."

1622: Fishermen from Damariscove Island give fish to the colonists in Plymouth, Massachusetts, who are in need of food just to survive.

1600s to mid-1800s: Fishermen fish close to shore aboard schooners by dropping lines over the side and pulling them by hand.

1700s: Lobster is used as bait, for fertilizer, and scorned as a poor man's food.

1760s: More than 60 vessels with 230 fishermen aboard them are fishing for cod and catching 3 million pounds a year.

Early 1800s: Fishermen develop the river fisheries, catching salmon, smelt, alewives, shad and sturgeon in bag nets and weirs set up in rivers.

Early 1800s: Herring (sardines) emerge as a fishery in eastern Maine, where the fish are smoked and pickled.

1816: Abraham Lurvey of Mount Desert Island invents the mackerel jig, beginning the commercial mackerel fishery.

1820s: Lobsters are caught commercially for the first time for coastal markets.

1830s: Fishermen fish for whales near shore. The small industry ends in the 1840s.

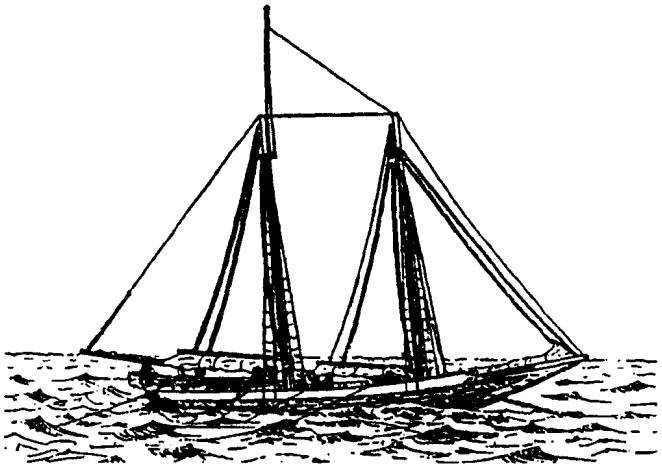
1840s: Canning factories are built to can lobsters, revolutionizing the lobster industry by allowing dealers to ship lobsters to inland markets.

Mid-1800s: The purse seine is developed and revolutionizes the mackerel fishery. Fishermen can catch tons of fish at a time by circling them and catching them with a drawstring-like net.

1858: The first trawl line is developed. Rather than dropping single lines over the sides of boats, fishermen fish with lines with many hooks that are anchored and pulled every few days. Trawl lines don't replace handlines completely until the 1890s.

1860s: The pogy industry starts after the Civil War. Factories are built to turn the fish into oil and fertilizer.

1860s: Clams are sold commercially for the first time. Previously, they were harvested only for bait.



1870-71: The herring industry booms during the Franco-Prussian War. The war cuts off the supply of "Russian sardines" for the Germans, and the American herring becomes a substitute.

1889: Lobstermen catch 24 million pounds of lobster, a record that stands until 1990.

1900: Seventy-five sardine canneries are operating on the coast of Maine.

1910: Scallop landings from the Gulf of Maine reach more than 1.8 million pounds, a record that stands today.

1920s: Engines replace sails on fishing boats, making fishing more efficient.

1949: Forty-seven sardine plants are operating in Maine. The number has declined every year since then.

1950: Maine fishermen harvest 356 million pounds of fish, a record that stands today.

1960s: Foreign fishing boats from Canada, Russia, Poland, East Germany and other countries pound the fishing grounds of Georges Bank and the Gulf of Maine, coming as close as 12 miles to shore.

1976: Congress passes the Magnuson Act, a national fish management plan that establishes the 200-mile American fishing zone and kicks out foreign fishing vessels.

1984: The World Court in the Hague establishes a fishing boundary, known as the Hague Line, that divides the Gulf of Maine and Georges Bank fishing grounds between Canada and the United States. The decision takes prime fishing areas away from New England fishermen.

1994: Fish stocks hit all-time lows and several stocks are deemed scientifically "collapsed." Scientists recommend closing Georges Bank to commercial fishing. Strict new groundfishing laws go into effect that will cut by half the number of days fishermen can catch groundfish.

Information cited from "Empty Nets, Sinking Hopes," Portland Press Herald, September 18, 1994.

WHAT'S A FISH?
..... AND WHAT'S THE DIFFERENCE?

Fish belong to a group of back-boned animals completely adapted for life in the water. These aquatic vertebrates have fins, scales and breathe by means of gills. Fish are cold-blooded which means that their body temperature varies with the temperature of the water.

Fossils show that fish lived in the waters of the world more than 400 million years ago. That's longer than most other living creatures on earth. The earliest fish-like creatures, called ostracoderms, were covered with a heavy armor of overlapping scales.

Fish live in the water from the polar regions to the equator. They can survive in depths of a few inches to as much as five miles or more beneath the surface of the sea.

Fish, like all life forms, have two names—a common name and a scientific one. Every species of fish has only one scientific name. The scientific name is in Latin and has two parts. The first name represents the genus and the second the species. Genus is the main subdivision of a family of fishes and is made up of a small group of closely related species. The genus is capitalized. The second word refers to only one species and is not capitalized.

Common names can sometimes be confusing because anglers in different regions have different names for the same fish. Each angler should be able to identify locally popular sport and gamefish. However learning to correctly name the various species requires practice. Once a particular species has been seen a few times, anglers can begin to recognize the distinguishing traits.

Learning fish anatomy and recognizing different species is more than an academic exercise. It teaches anglers about a fish's life. The physical characteristics of a fish are adapted to its habitat, and determines the food it will eat.

Many people wonder about the difference between freshwater fish and saltwater fish. What is the difference? ....the kidney. Saltwater fish have a kidney that keeps the proper balance of salt in their system. Freshwater fish do not have this capability. Therefore, if you put a freshwater fish in saltwater, it cannot adjust to the salt in the water and will die immediately. Some fish can live in both salt and fresh water. Salmon and striped bass are common anadromous fish. They spawn in fresh water and then migrate to salt water. The eel is a catadromous species, because it spawns in the ocean and then migrates to the fresh water.

Now let's look at the anatomy of a fish.

FORM: A fish's form depends on its environment. Nature has given each species a form that allows it to survive and reproduce. (compressed, flat, snake-like, triangular, globular, and spindle)

FINS: A fish's dorsal fins are on the top of the fish. Some fish have several dorsal fins. There are also fins on the belly and sides of the fish. Fish use their fins for direction, movement, and to help them hover in one place.

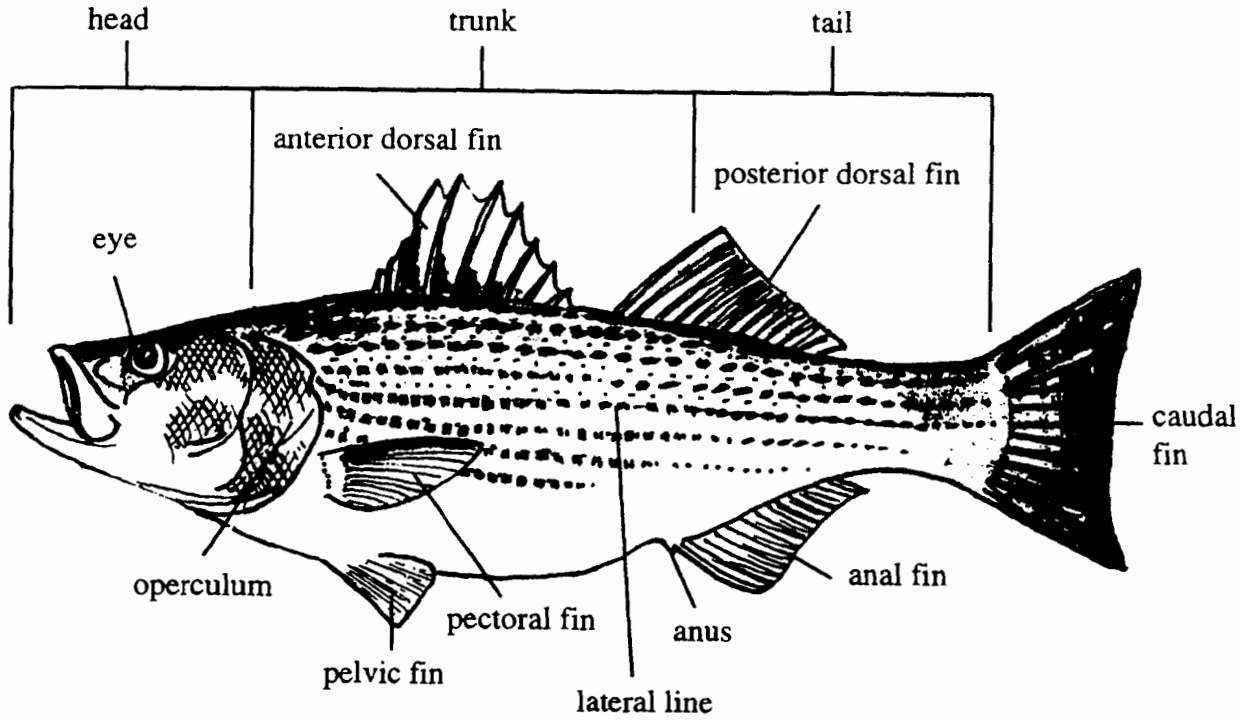
SCALES: Scales cover the outside of a fish, and serve as a protection against disease and parasites.

COLOR: A fish's color helps it to hide from predators, and helps identify different species. Some fish can even change their color.

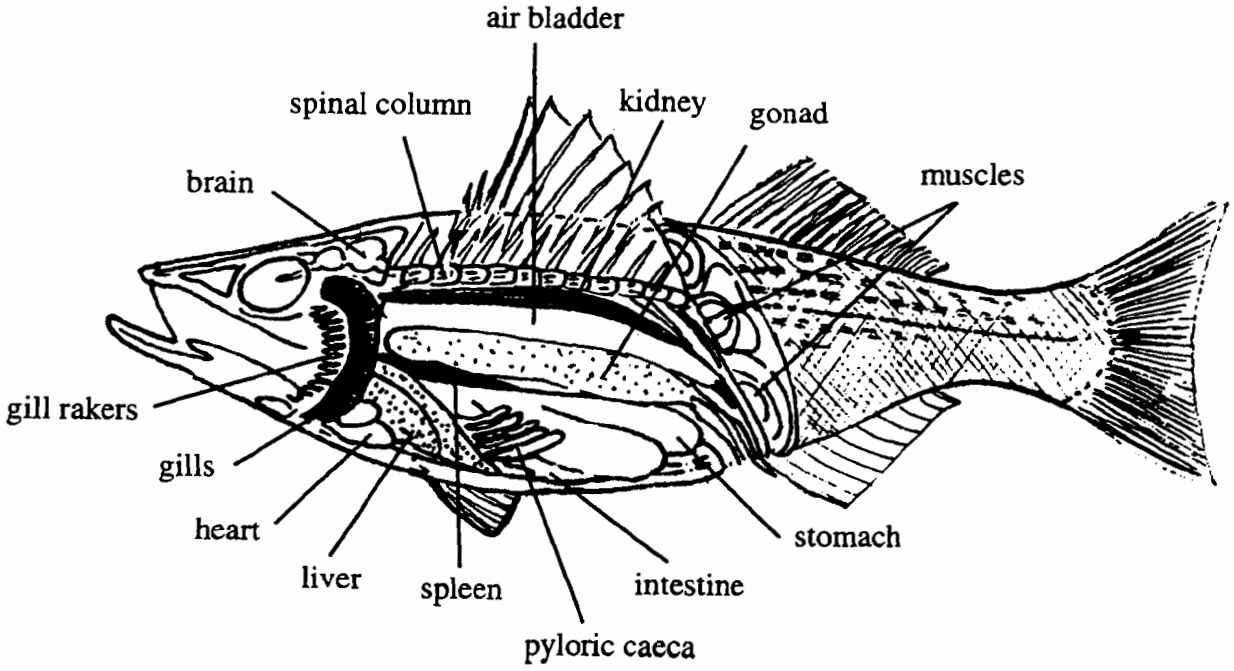
SKELETON: A fish needs a skeleton for many of the same reasons that people need bones. A skeleton protects vital internal organs and supports the muscles for shape and movement.

GILLS: Fish use their gills to breathe. Water enters the fish's mouth and passes through the gills. The gills remove the oxygen so that it can be used by the fish.

External Anatomy

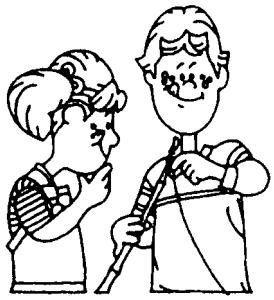


Internal Anatomy



Fishing.... How to Get Started

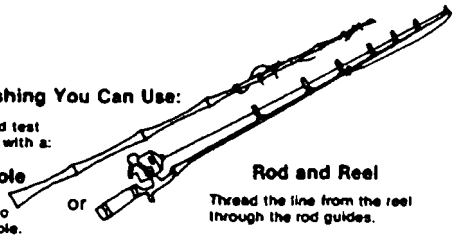
"I've heard fishing is fun. It's also easy to learn. What are you doing?"



"I'm making a rod so I can go fishing with you."

To Go Fishing You Can Use:

6 to 12 pound test Fishing Line with a:



Cane Pole

Tie the line to end of the pole.

or

Rod and Reel

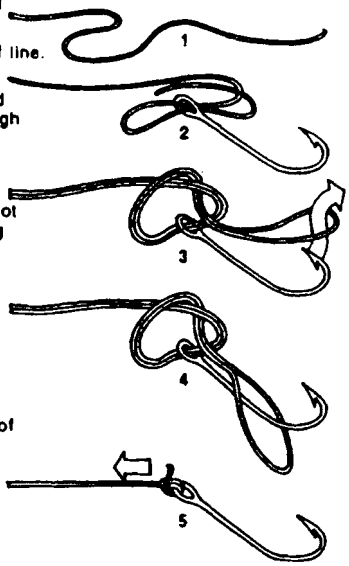
Thread the line from the reel through the rod guides.

"Why does my plug keep breaking off?"

"Because you don't know how to tie a strong knot. I can show you."

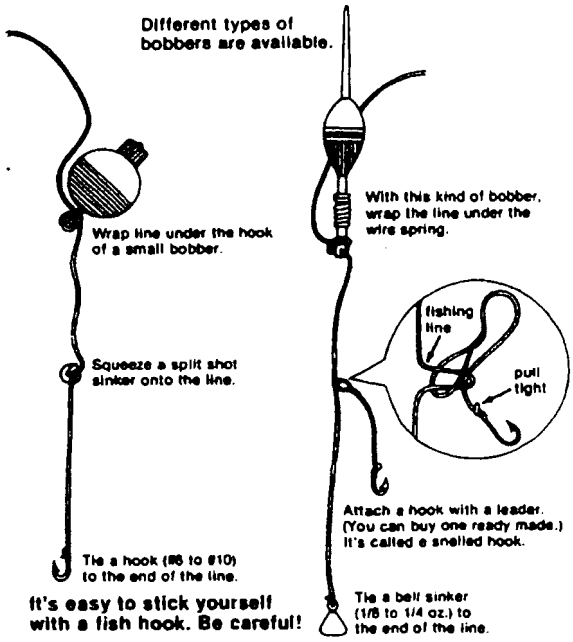
"The PALOMAR KNOT is an easy one to tie.

1. Start with plenty of line.
2. Double the line and pass the end through the hook's eye.
3. Tie an overhand knot (like you were tying your shoe strings) but do not pull it tight yet.
4. Pass the hook through the loop.
5. Pull the loose end of line to tighten the knot. Trim the end. Leave at least 1/8 inch of your line at the knot."



Illustrations from "Fishing Fun For Kids" booklet produced by the Future Fisherman Foundation.

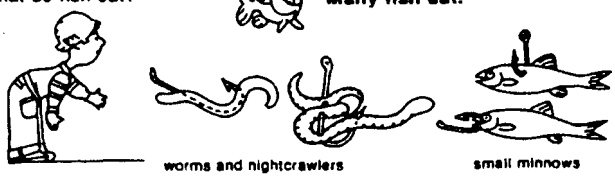
Here Are Two Easy Ways To Get Your Line Ready



It's easy to stick yourself with a fish hook. Be careful!

"Now we need some bait. What do fish eat?"

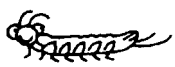
Many fish eat:



worms and nightcrawlers

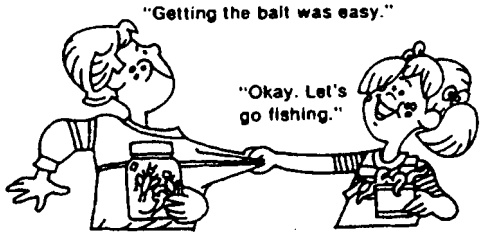
small minnows

grasshoppers and crickets



They eat most small crawly things.

"Getting the bait was easy."



Tidepools

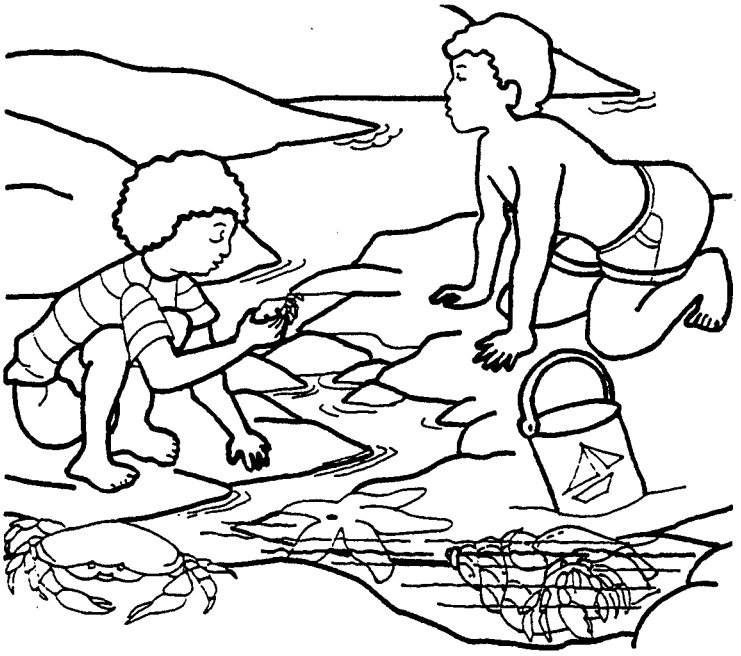
What is a tidepool?

Along the rocky shores of Maine, the tide rises and falls twice each day creating a strip of land called the intertidal zone. This zone is covered by water during high tide and exposed to the air when the tide is low. As the tide recedes, pools of water called tidepools are left behind in the cracks and crevices of the rocky shore.

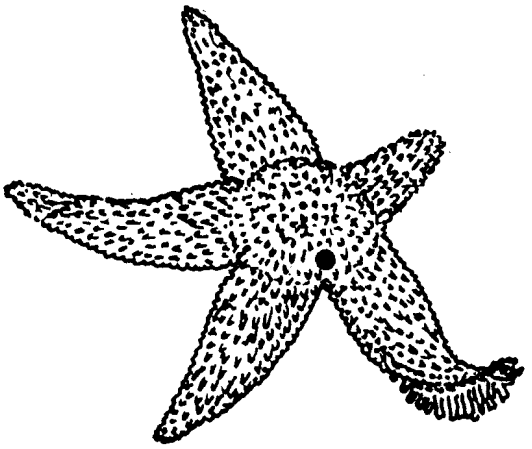
What lives in a tidepool?

Most of the animals in a tidepool are animals without backbones called invertebrates. These animals include sea stars, sea urchins, crabs, sea anemones, periwinkles, barnacles, and mussels. Tidepools are also filled with a variety of seaweeds such as sea lettuce, rockweed, knotted wrack, and Irish moss. The plants and animals that live in the tidepools are well adapted to the harsh conditions of this environment. They must be able to withstand the drying effects of low tide, crashing waves, and rapid changes in temperature and salinity.

Animals and plants live in different areas of the rocky shore according to their needs. Animals that must be wet, like sea anemones and sea urchins live below the low tide mark. Others, like periwinkles, mussels, and barnacles, hold water in their shells and can live in areas uncovered at low tide. Crabs and sea stars move to follow the tide or hide among seaweeds and under rocks to stay wet.

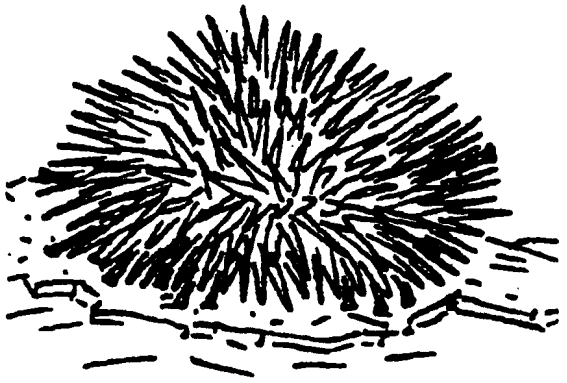


Tidepool Animals



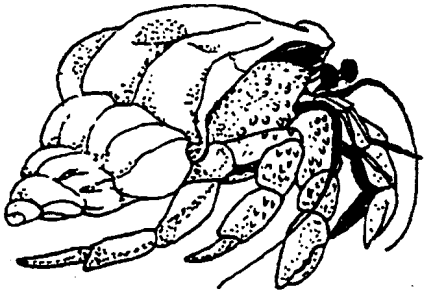
Sea Star

Though a sea star is sometimes called a starfish, it is not a fish at all. It belongs to a special group of ocean animals called "echinoderms," or animals with spiny skin. A sea star has five eyespots, one at the end of each arm, to detect light. Along the underside of a sea star are hundreds of flexible feet, called tube feet. Each of these tube feet has a suction cup on the end for crawling and holding on. These tube feet are also used to pull apart the shells of mussels and clams, which a sea star likes to eat. When feeding, it sticks its stomach out of its mouth which is centrally located on the underside.



Sea Urchin

A sea urchin has a hard, round skeleton covered with spines for protection. Slender feet, called tube feet, are found between the spines. Each tube foot has a suction disk on the end for crawling and holding on. Its mouth is centrally located on its underside. A sea urchin uses its five teeth to chew on seaweeds and scrape algae off the rocks for food.



Hermit Crab

While most crabs grow their own shell for protection, the hermit crab borrows one. This crab lives inside an empty snail shell. When threatened, it pulls its body completely inside the shell for protection of its soft tail or abdomen. As the hermit crab outgrows its borrowed home, it searches for a larger shell to move into.

Barnacles

Barnacles are found high on the rocks at the edge of tide pools. They have hard, rock-like shells that protect them from enemies. When the tide is low, barnacles close their shell-like casing to protect themselves from drying out. At high tide, they open their shells to feed on plankton. They use their 6 pairs of feathery legs to capture the tiny plants and animals.

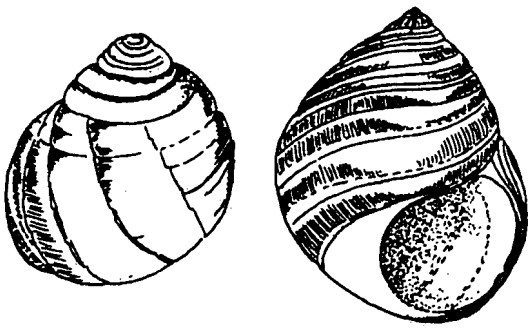
Tidepool Animals

Green Crab

The green crab has four pairs of legs for walking sideways, a pair of claws for feeding and self-defense, and a hard shell for protection. As the crab grows, its shell becomes too small and it must molt or shed its shell. After molting, the crab hides for a few days until its new shell has hardened. The green crab is a scavenger. It will eat dead animals, live worms, and even other crabs.

Mussels

Mussels belong to a group called mollusks. Their soft bodies are protected by two hard shells. At high tide, mussels slightly open their shells to feed. They filter tiny plants and animals from the water. At low tide, their blue-black shells close tightly to prevent them from drying out. In Maine, there are several fish farms that raise mussels in a process called aquaculture.



Periwinkles

Three types of periwinkles live in the intertidal zone; common, smooth, and rough. They all have a large, muscular foot that attaches firmly to rocks and seaweeds. Periwinkles have a tongue that is covered with small teeth. In order to eat, they scrape algae off from the rocks.

Sea Anemone

The sea anemone is a soft bodied animal that some people say looks like an undersea flower. Even though it attaches itself to the bottom, it is capable of moving slowly. It, along with its relative the jellyfish, has tentacles that surround its mouth. It uses these tentacles to trap its food.

Seaweeds

There are many types of seaweeds that grow along the coast of Maine. They are called algae and are grouped according to color (red, green, and brown). In the tidepool, seaweeds provide food and hiding places for many small animals.

Sea Lettuce

Sea lettuce is a bright green algae. Its blade is lettuce-like in shape and texture. In the Orient, sea lettuce is used to make soup. In Scotland, it is used for salads.

Irish Moss

Although you might expect Irish moss to be green, it is usually a deep red color. Sometimes there is so much Irish moss in one place that it looks like a thick red carpet. Many people use this seaweed to make a pudding called "blancmange."

Rockweed

As its name suggests, this brown seaweed holds on tightly to rocks in the intertidal zone. The bubbles, or air bladders, in its blades keep it afloat during high tide. During low tide, crabs may be found hiding under bunches of rockweed.

Kelp

Kelp is the largest form of algae that grows along the coast of Maine. It's long, flat blade is attached to a tube-like stalk. This brown seaweed can be seen only at the low tide mark or below low tide.

Adapted from *Life on Rocky Shores*, New England Aquarium.

2

Aquarium Activities

Observing Animal Behavior

Biologists describe the behavior of animals in an effort to understand how they live. While you are visiting the Marine Resources Aquarium, you will spend time observing live animals to determine their behavior.

Choose an animal and observe it closely for 5 minutes.
Record the following information:

sketch

Common name: _____

Scientific name: _____

Natural habitat: _____

Color(s): _____

Size: _____

Movement: _____

Interaction with tank mate: _____

Food Getting: _____

Protection: _____

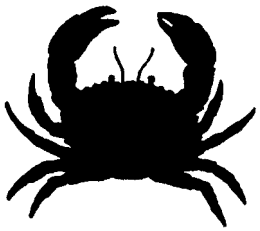
Unusual Features: _____

_____

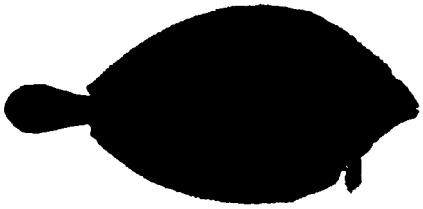
_____

Which ocean animals are these?

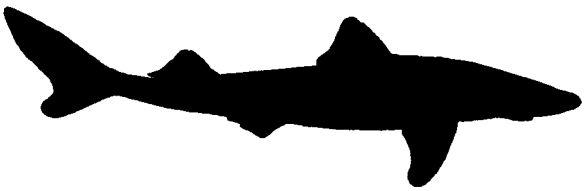
Find these animals at the Marine Resources Aquarium.
Draw a line from their name to their silhouette.



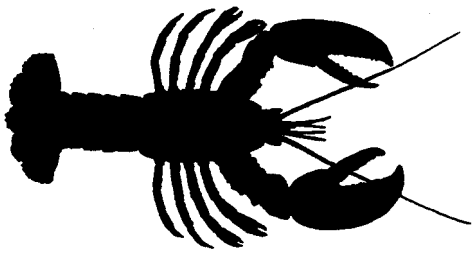
flounder



sea urchin

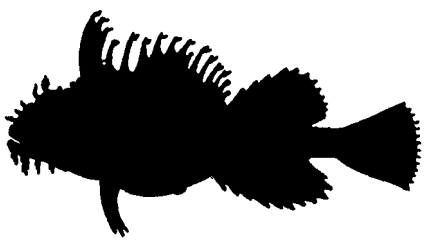


sculpin



crab

dogfish

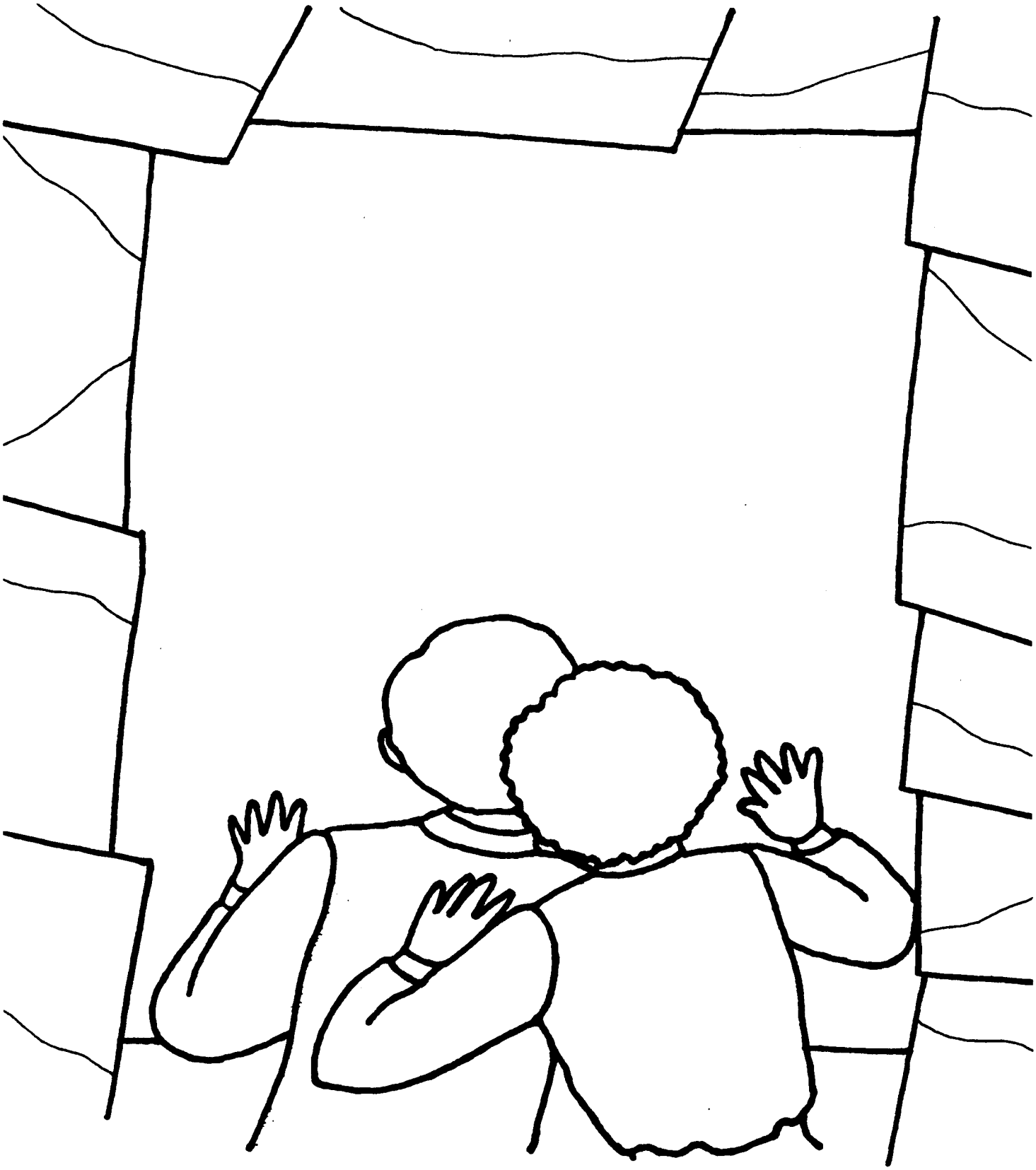


lobster

My Favorite Exhibit Sketch

Name of Aquarium Exhibit _____

Animals _____

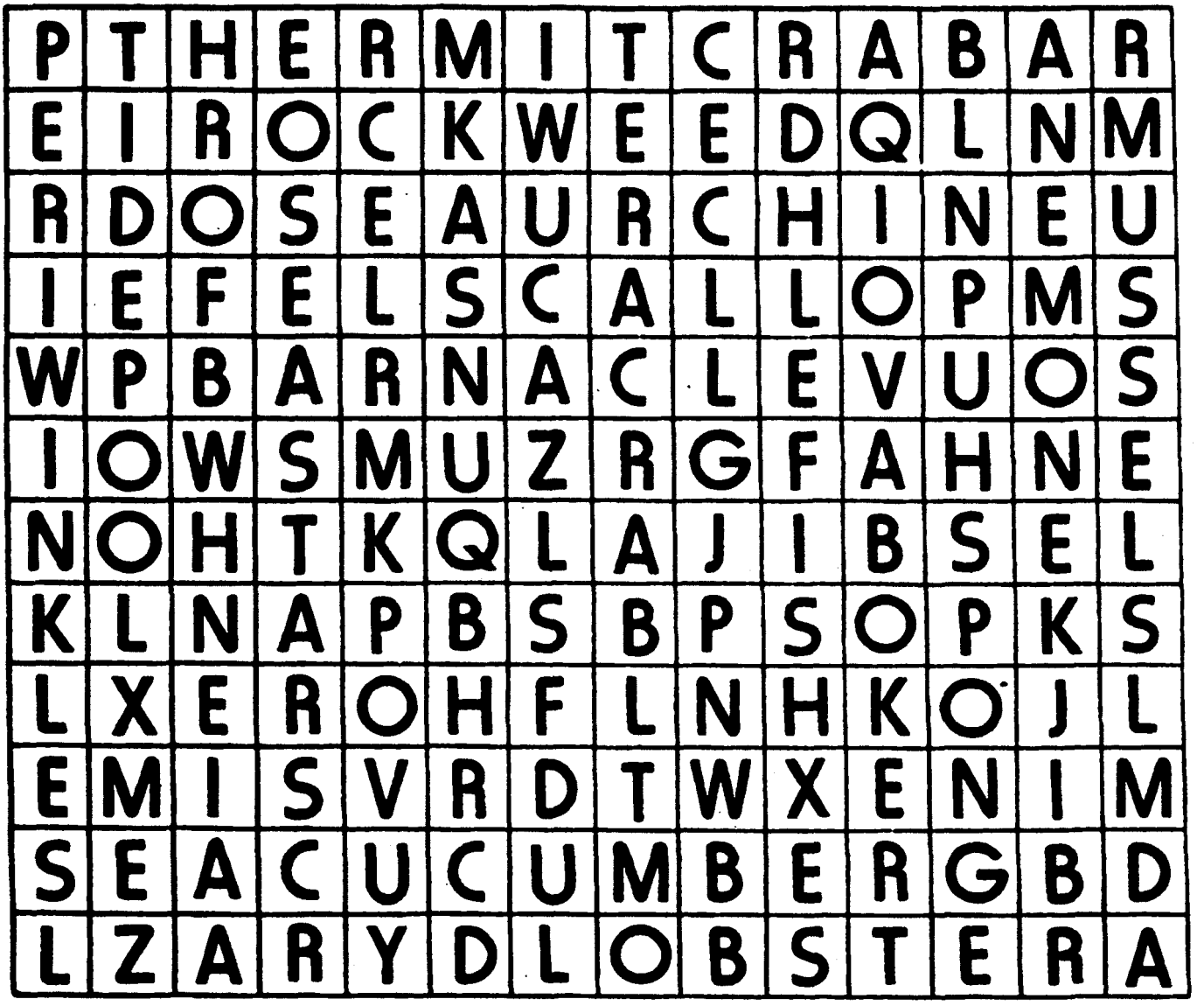


Name of Artist _____ Date _____

3

Post-trip Activities

Aquarium Word Search

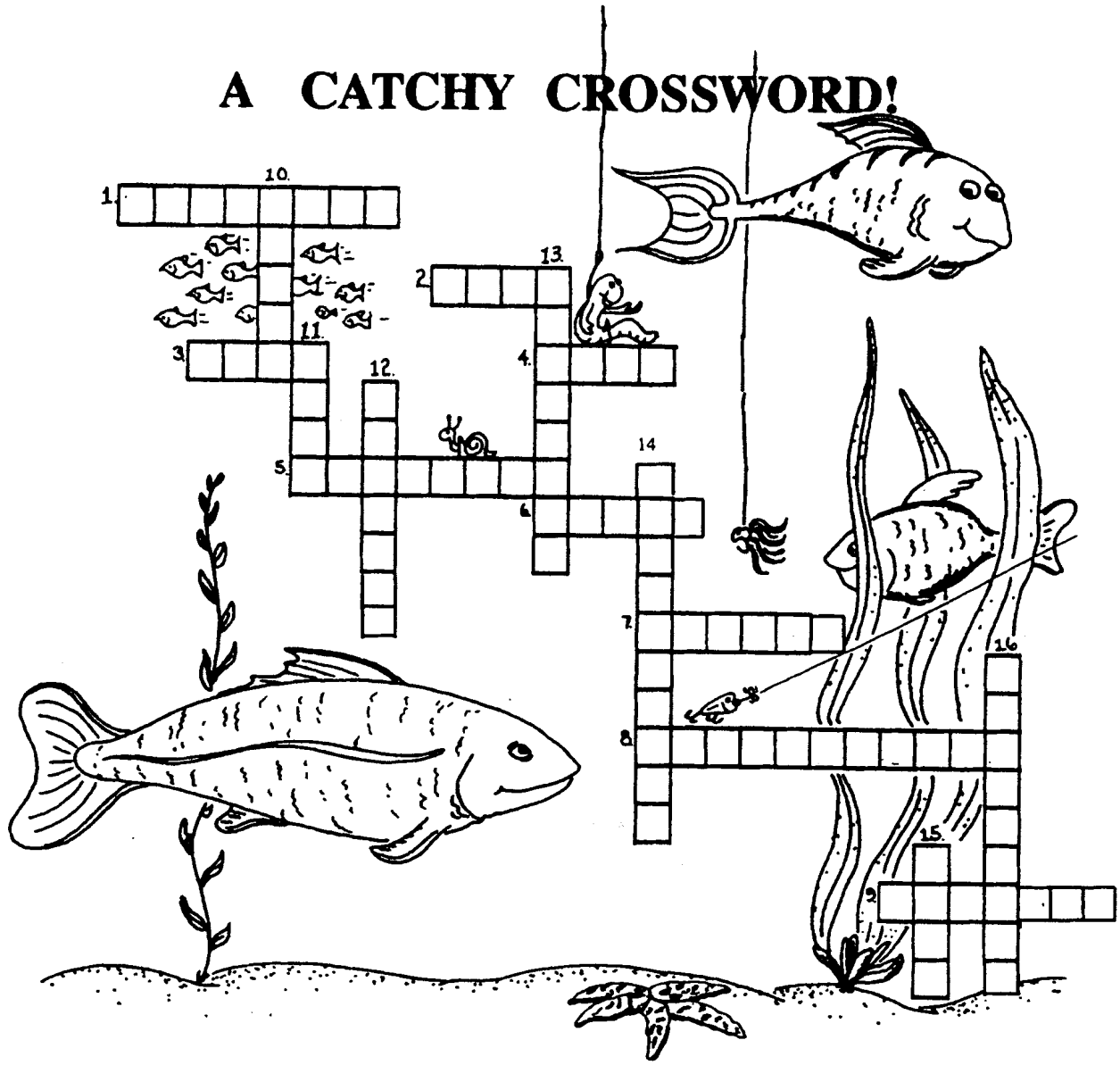


P	T	H	E	R	M	I	T	C	R	A	B	A	R
E	I	R	O	C	K	W	E	E	D	Q	L	N	M
R	D	O	S	E	A	U	R	C	H	I	N	E	U
I	E	F	E	L	S	C	A	L	L	O	P	M	S
W	P	B	A	R	N	A	C	L	E	V	U	O	S
I	O	W	S	M	U	Z	R	G	F	A	H	N	E
N	O	H	T	K	Q	L	A	J	I	B	S	E	L
K	L	N	A	P	B	S	B	P	S	O	P	K	S
L	X	E	R	O	H	F	L	N	H	K	O	J	L
E	M	I	S	V	R	D	T	W	X	E	N	I	M
S	E	A	C	U	C	U	M	B	E	R	G	B	D
L	Z	A	R	Y	D	L	O	B	S	T	E	R	A

Find and circle the words that are hidden in the puzzle. All the words read from top to bottom or left to right. You should find 15 words.

FISH
PERIWINKLE
MUSSEL
SCALLOP
SEA URCHIN
HERMIT CRAB
BARNACLE
SEA CUCUMBER
ROCKWEED
ANEMONE
TIDEPOOL
LOBSTER
CRAB
SPONGE
SEA STAR

A CATCHY CROSSWORD!



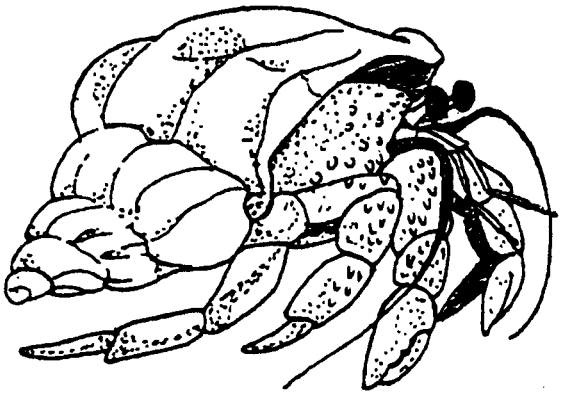
ACROSS

1. Fish and ocean animals can be seen at the Marine Resources _____.
2. Striped _____ are caught by sport fishermen.
3. An artificial object used to catch fish.
4. Rod and _____.
5. Water caught between the rocks at low tide
6. Seaweeds
7. A Sea _____ is a spiny skinned animal.
8. Another name for fish farming.
9. Sardine

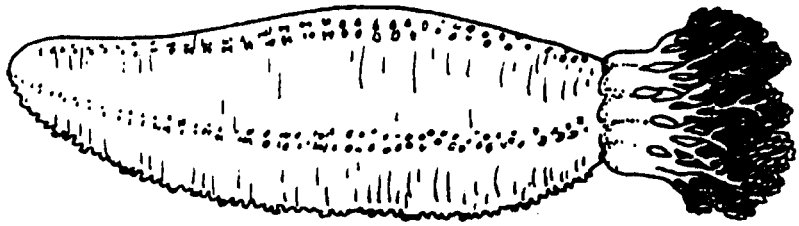
DOWN

10. Salmon spawn up _____.
11. North, south, _____, or west
12. Bait worms are dug here.
13. Largest clam in Maine that is sometimes called a "hen" clam. (2 words)
14. A flounder can match color with its surroundings.
15. Largest type of seaweed
16. Intertidal crustacean (2 words)

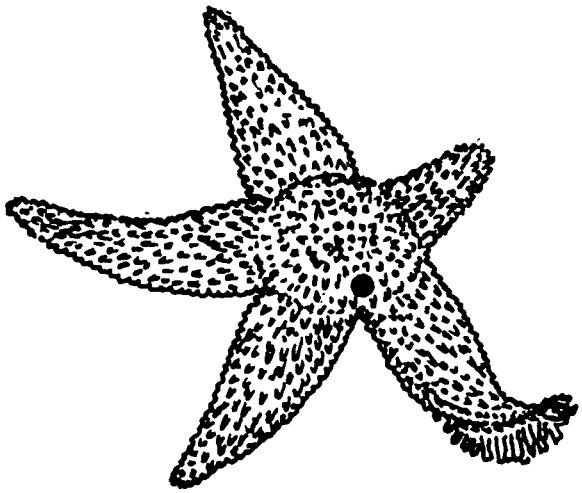
Coloring Sheet



hermit crab



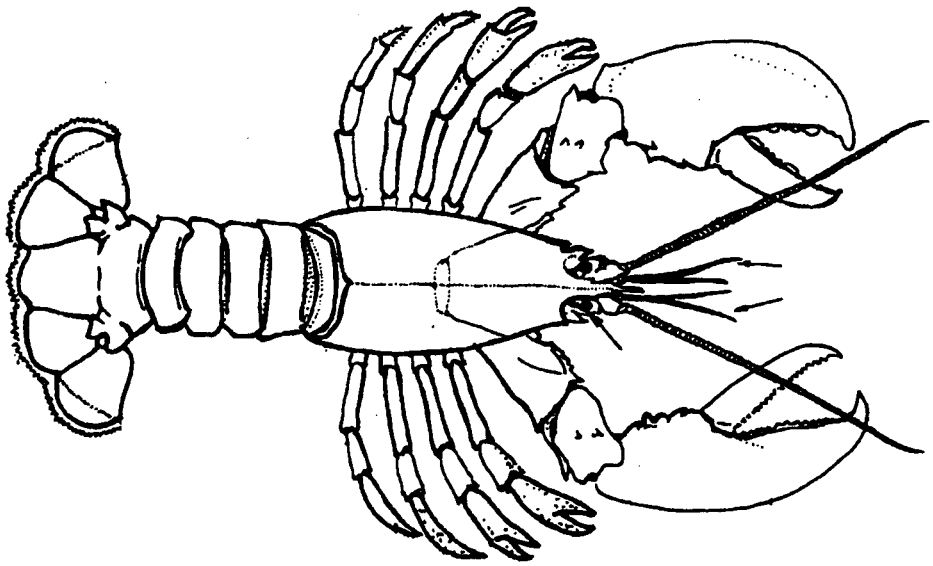
sea cucumber



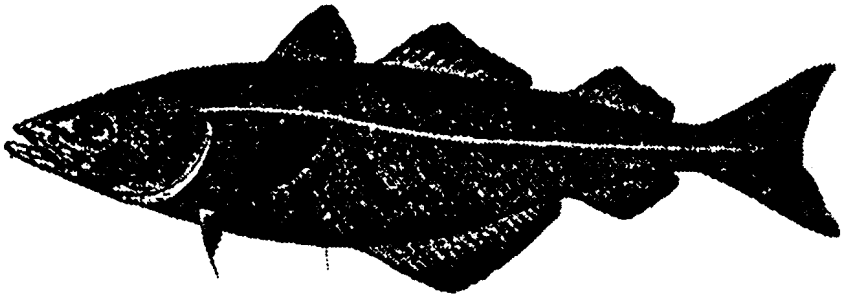
sea star

sea anemone

lobster

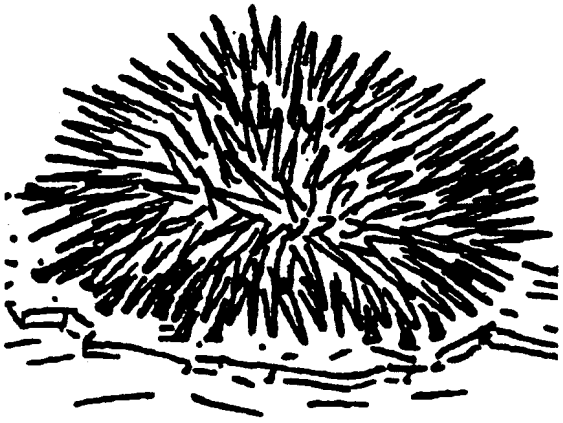


Coloring Sheet

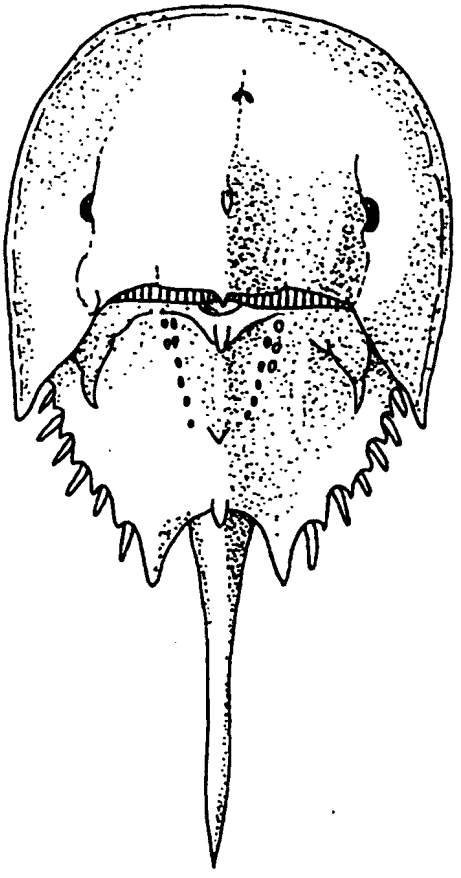


pollock

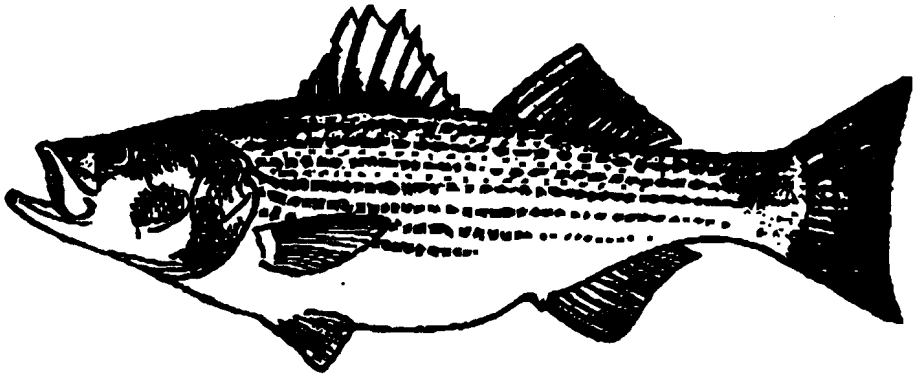
mussels



sea urchin



horseshoe crab



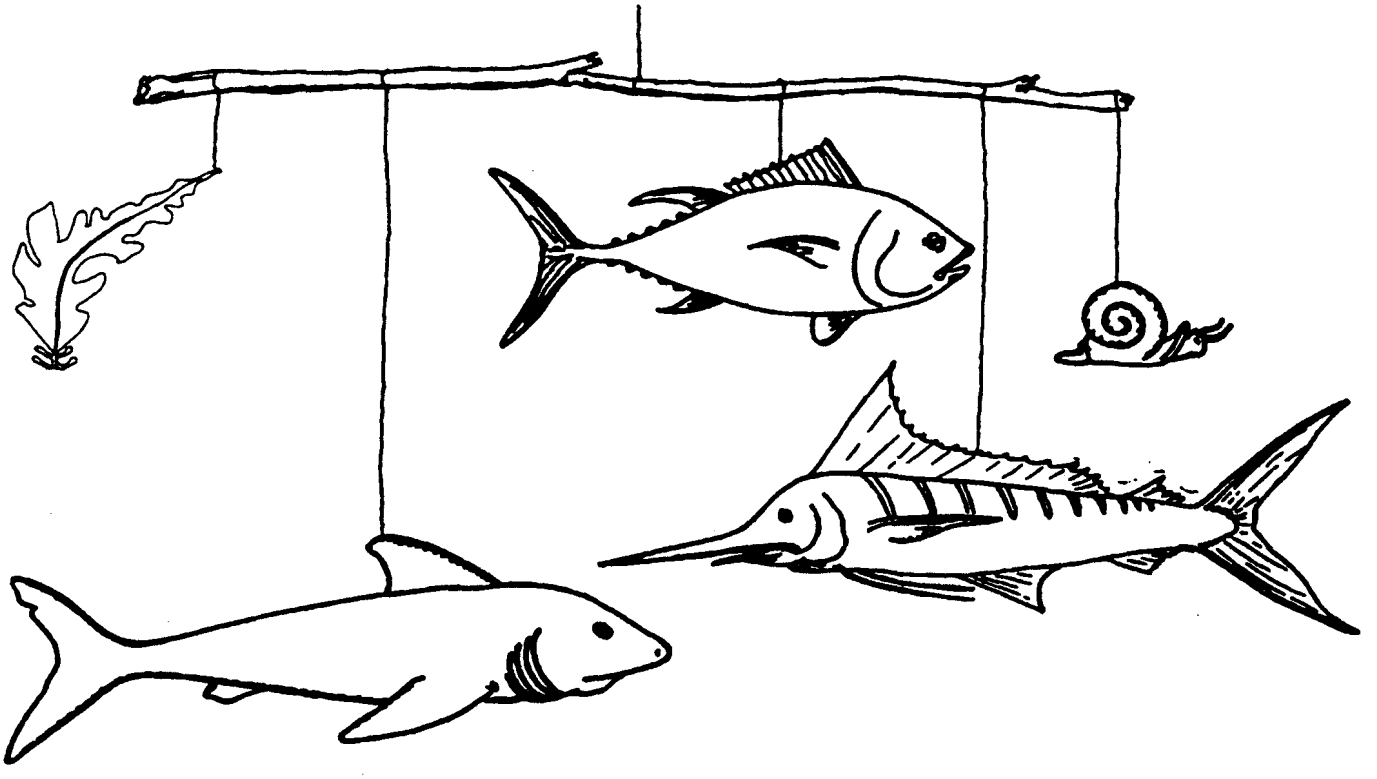
striped bass

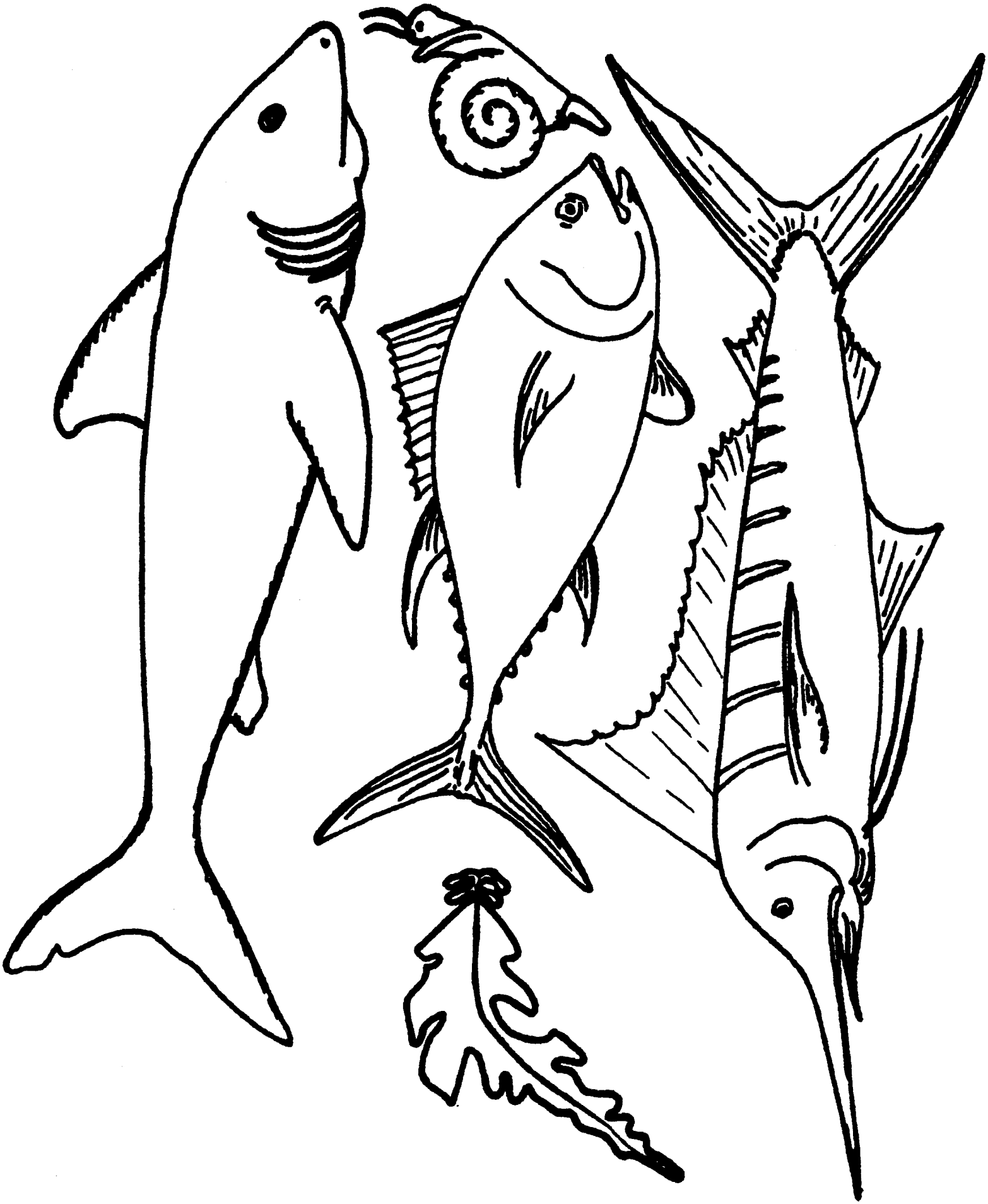
Mobile

In the environment, everything is connected. If pollution kills the plants, then the little fish die. If the little fish die, then the big fish die. If all the fish and plants die, then what kind of environment will we have to live in? We must respect nature and take care of it. These objects below can be cut out and made into a mobile, to remind you of the balance of nature. Don't forget.... your environment is your responsibility.

How to Make a Mobile

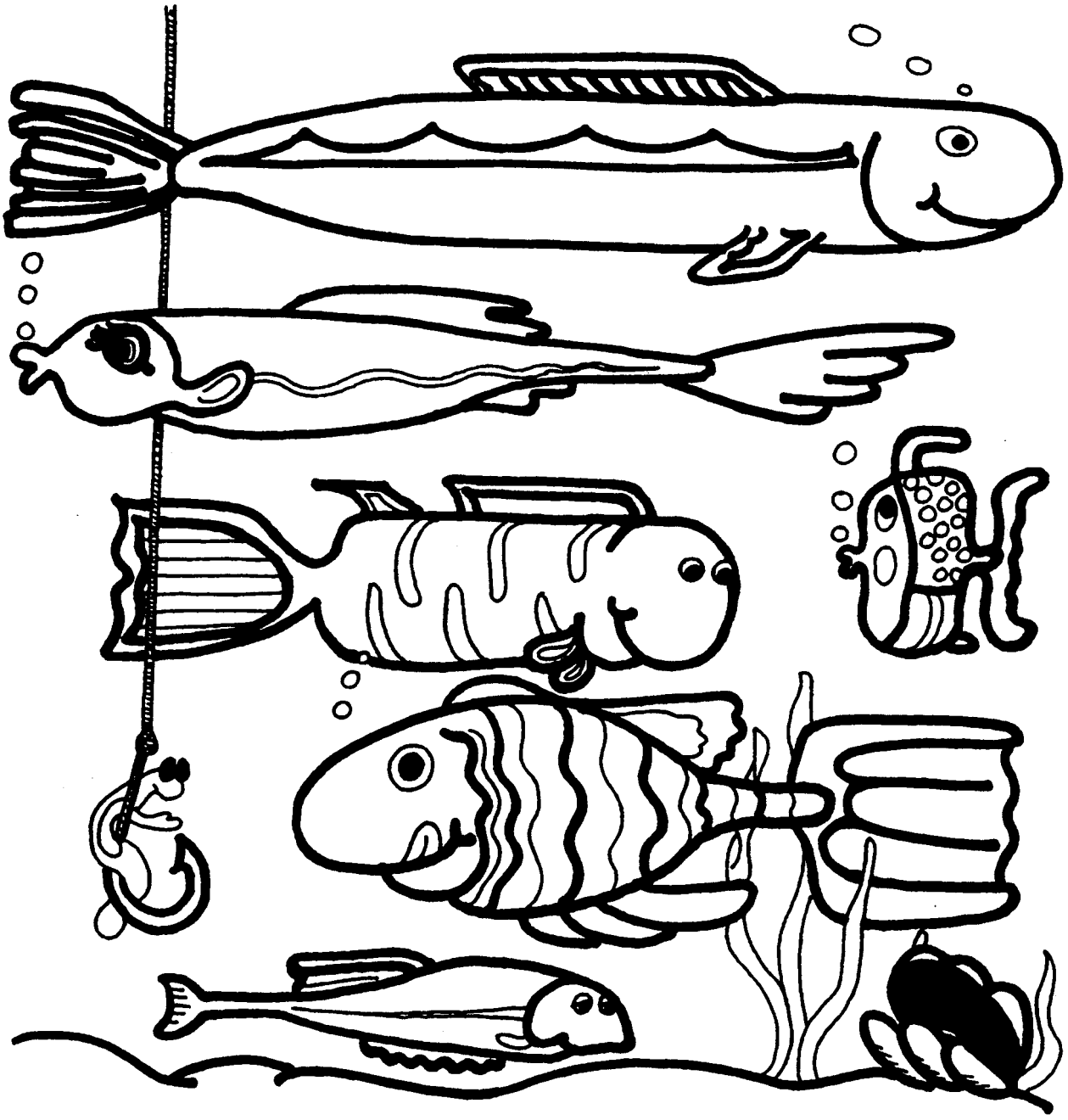
Get an old stick from the ground, some string, yarn, or fishing line, and your crayons. Paste the pictures to a piece of construction paper, color the objects and then cut them out. Punch a hole in the top of each object and use the yarn to tie the object on the stick. Remember, a mobile must be balanced. So make sure that each object is spaced out properly. Try hanging the plant and animals at different levels. Tie a piece of yarn on the top of the stick so that you can hang it. Hang your mobile up and let it remind you to take care of the environment.





WHICH FISH ARE "KEEPERS"?

In Maine, fish have to be a certain length to be considered a "keeper." It is very important to know the rules of fishing! In this activity, the rule is that fish must be 4 inches long. Measure all of the fish. Color the fish that are "keepers."



Word Scramble

When you go fishing you will need hooks, line, a fishing pole, bait, and patience. Practice your patience by unscrambling these fishy words!

OSLANM _____

TBAO _____

SNFI _____

HISNIGF _____

SERNKSI _____

KELXAOCTB _____

BREBOSB _____

SELCAS _____

TBIA _____

ODR ____